



Designation: F1572 – 21

Standard Test Methods for Tire Performance Testing on Snow and Ice Surfaces¹

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1. Scope

1.1 These test methods cover the evaluation of tire performance on snow and ice surfaces utilizing passenger car or light truck vehicles. Since the tires are evaluated as part of a tire/vehicle system, the conclusions reached may not be applicable to the same tires tested on a different vehicle.

1.2 These test methods do not purport to identify every maneuver useful for determining tire performance in a winter environment.

1.3 These test methods are not meant to evaluate vehicle performance. Allowing for the variability of test results with different vehicles, these procedures have been developed and selected to evaluate relative tire-snow performance.

1.4 These test methods are suitable for research and development purposes, where tires are compared during a single series of tests. They may not be suitable for regulatory statutes or specification acceptance because the values obtained may not necessarily agree or correlate either in rank order or absolute traction performance level with those obtained under other environmental conditions on other surfaces or the same surface after additional use.

1.5 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ These test methods are under the jurisdiction of ASTM Committee F09 on Tires and are the direct responsibility of Subcommittee F09.20 on Vehicular Testing.

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2. Referenced Documents

2.1 ASTM Standards:²

E178 Practice for Dealing With Outlying Observations

E1136 Specification for P195/75R14 Radial Standard Reference Test Tire

F457 Test Method for Speed and Distance Calibration of Fifth Wheel Equipped With Either Analog or Digital Instrumentation

F538 Terminology Relating to Characteristics and Performance of Tires

F811 Practice for Accelerometer Use in Vehicles for Tire Testing

F1046 Guide for Preparing Artificially Worn Passenger and Light Truck Tires for Testing

F1650 Practice for Evaluating Tire Traction Performance Data Under Varying Test Conditions

F1805 Test Method for Single Wheel Driving Traction in a Straight Line on Snow- and Ice-Covered Surfaces

F2493 Specification for P225/60R16 97S Radial Standard Reference Test Tire

2.2 SAE Standards:³

SAE J1466 Passenger Car and Light Truck Tire Dynamic Driving Traction in Snow

3. Terminology

3.1 Definitions:

3.1.1 *candidate tire (set), n*—a test tire (or test tire set) that is part of an evaluation program; each candidate tire (set) usually has certain unique design or other features that distinguish it from other candidate tires (sets) in the program. **F538**

3.1.2 *control tire (set), n*—a reference tire (or reference set) repeatedly tested in a specified sequence, typically in conjunction with a candidate tire (set), throughout an evaluation program.

3.1.2.1 *Discussion*—Control tires (sets) are used for adjustment of data sets generated from an evaluation program or the statistical procedures used on data sets, or both, in order to

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from SAE Automotive Headquarters, 755 W. Big Beaver, Suite 1600, Troy, MI 48084.

offset or reduce variation in test results. They can also be used to improve the accuracy of candidate tire (set) data and to detect variation in test equipment. **F538**

3.1.3 *driving coefficient [nd]*, *n*—the ratio of the driving force to a normal force. **F538**

3.1.4 *driving force [F]*, *n*— of a tire, the positive longitudinal force resulting from the application of driving torque. **F538**

3.1.5 *grooming, v*—in tire testing, mechanically reworking a snow test surface in order to obtain a surface with more consistent properties. **F538**

3.1.6 *ice, dry, n*—smooth ice without loose surface materials. **F538**

3.1.7 *longitudinal force [F]*, *n*— of a tire, the component of the tire force vector in the X' direction. **F538**

3.1.8 *longitudinal slip velocity [L/T]*, *n*— the effective rolling radius multiplied by the difference between the spin velocity (in rad/unit time) of a driven or braked tire and that of a free rolling tire when each is traveling in a straight line. **F538**

3.1.9 *reference tire (set)*, *n*—a special test tire (test tire set) that is used as a base value or benchmark included in an evaluation program; these tires usually have carefully controlled design features to minimize variation. **F538**

3.1.10 *snow, hard pack, n*— in tire testing, packed base without loose snow. **F538**

3.1.11 *snow, medium hard pack, n*— in tire testing, packed base with some loose snow. **F538**

3.1.12 *snow, medium pack, n*— in tire testing, groomed packed base with 2.5 to 5.0 cm (1 to 2 in.) loose snow. **F538**

3.1.13 *snow, soft pack, n*— in tire testing, freshly fallen or deeply groomed base snow with 5.0 to 7.5 cm (2 to 3 in.) loose snow. **F538**

3.1.14 *spin velocity, n*—the angular velocity of the wheel about its spin axis. **F538**

3.1.15 *standard reference test tire (SRTT)*, *n*—a tire that is commonly used as a control tire or surface monitoring tire and meets the requirements for one of the Specifications **E1136** or **F2493**.

3.1.15.1 *Discussion*—This is a Type 1 reference tire.

3.1.15.2 *Discussion*—A surface monitoring tire may also be used as a control tire. **F538**

3.1.16 *surface monitoring tire (set)*, *n*—a reference tire (or reference set) used to evaluate changes in a test surface over a selected time period. **F538**

3.1.17 *test (or testing)*, *n*—a technical procedure, method, or guide performed on an object (or set of objects) that produces data; the data is used to evaluate or model properties or characteristics of the object (or set of objects).

3.1.17.1 *Discussion*—Test data are used to evaluate or model selected properties or characteristics of the object (or set of objects). The scope of testing depends on the decisions to be made for any program, and sampling and replication plans (see definitions below) need to be specified for a complete program description. **F538**

3.1.18 *test matrix, n*—a group of candidate tires usually with specified reference tires; all tests are normally conducted in one test program. **F538**

3.1.19 *test tire (set)*, *n*—one or more tires, as required by the test equipment or procedure to perform a test, producing a single test result; the tires within a test tire set are usually nominally identical.

3.1.19.1 *Discussion*—The four nominally identical tires required for vehicle stopping distance testing constitute a test tire set. In the discussion below where the test tire is mentioned, it is assumed that the test tire set may be submitted for test tire, if a test tire set is required for the testing. **F538**

3.1.20 *vertical load, n*—the normal reaction of the tire on the road which is equal to the negative of normal force. **F538**

4. Summary of Test Method

4.1 These test methods describe a series of vehicle maneuvers which can be utilized by the tire and vehicle industry to consistently measure the properties of a tire's performance on snow and ice surfaces in the braking, driving and cornering traction modes.

4.2 These test methods outline the procedures for conducting the following tests:

- 4.2.1 Road circuit handling,
- 4.2.2 Winter hill climb,
- 4.2.3 Winter slalom,
- 4.2.4 Acceleration—straight ahead,
- 4.2.5 Braking—straight ahead, and
- 4.2.6 Step steer.

5. Significance and Use

5.1 These test methods describe techniques for assessing the performance characteristics of tires in a winter environment on snow and ice surfaces in a standardized manner. When only snow is referred to hereafter, it should be understood that ice is implied as appropriate.

5.2 A series of maneuvers are conducted to characterize several aspects of the tire performance in snow, since a single maneuver is not sufficient to characterize all aspects of a tire's performance.

6. Interferences

6.1 Factors which may affect tire snow performance and must be considered in the final analysis of data include:

- 6.1.1 Snow/ambient temperature,
- 6.1.2 Mechanical breakdown of snowflake into granular crystals,
- 6.1.3 Solar heat load and tire temperature,
- 6.1.4 Tire wear condition or preparation,
- 6.1.5 Tire pressure and vertical load,
- 6.1.6 Test vehicle characteristics,
- 6.1.7 Snow surface characteristics,
- 6.1.8 Test driver, and
- 6.1.9 Rim selection.